NDIA FUZES CONFERENCE

Fuzes for Air Force Unguided and Precision Guided Weapons

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Air Armament Center
AAC/WMG
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Outline

- Update on Current Weapon Systems
- Fuzes: Inventory, Production
- The Business Case
- Challenges For Today’s Precision Guided Munitions/Fuzes

Pretend for A Moment That you are a Modern Weapon

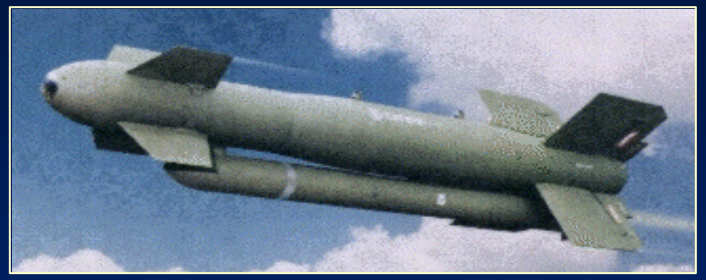
- **You are manufactured, then stored for 15 or 20 years**
- **You are transported around the world either in container, or loaded on an aircraft for multiple flights**
- **You are built up to the all up round level, and might or might not be tested prior to an operational mission**
- **You live in all environments-**
  - **Extreme temperature cycling, humidity, sand and dust, altitude, vibration, and salt fog**
- **You are provided complex inputs of where to go, and when to be safe, and when to explode**
- **And then:**

You must work!!

Current USAF Weapon Systems

- AGM-130
- AGM-142
- GBU/EGBU-15
- GBU/EGBU-24
- GBU/EGBU-27
- GBU/EGBU-28
- JDAM
- JASSM

AGM-130 Missile System Description



- Rocket Powered Standoff Precision Guided Missile
  - Man-in-the-Loop (MITL) Terminal Control
  - Interchangeable TV or IR Seekers
  - Interchangeable MK 84 or BLU-109 Penetrator Warhead
  - Fuzes: FMU-124, FMU-143 & FMU-152
  - Fully Autonomous INS/GPS Adverse Weather Capability
- Only U. S. Fighter Launched Air Force Standoff Weapon With 2,000 Pound Warhead
- Integrated on the F-15E Strike Eagle

AGM-142 Missile System Description

- Precision Guided, Standoff Weapon for Use Against High-Value/Heavily Defended Fixed Targets
  - Data Link Pod Augments Inertial Navigation
  - Interchangeable TV, IIR, or Z-Seeker
  - Interchangeable 750 Lb. Blast/Frag or 800 Lb. Penetrator Warheads
  - Fuzes: FMU-124 & FMU-143
- Only U.S. Bomber Launched Precision Weapon System
- Weapon of Choice for Multiple Allied Fighter Aircraft

GBU-15 Missile System Description

- Standoff Precision Guided Weapon System For Use Against High-Value Fixed Targets
  - Man-in-the-Loop (MITL) Terminal Control
  - Interchangeable TV or IIR seeker
  - Interchangeable MK 84 or BLU-109 Penetrator Warhead
  - Fuzes: FMU-124, FMU-143 & FMU-152
- Integrated on the F-15E Strike Eagle

EGBU-15 Missile System Description

- **Platform:** F-15E
- **Warheads:** MK-84/BLU-109
- **Seekers:** TV or IIR
- **Fuzes** FMU-124, FMU-143, FMU-152
- **Guidance:** Autonomous GPS, Man-in-the-Loop

GBU/EGBU-24 Missile System Description

- Laser Guided Munition Designed for Horizontal and Vertical, Hardened and Deeply Buried Targets
  - Laser Designator (Aircraft or Ground)
  - Laser Guided MK 84 or BLU-109A/B 2000 Lb. Warhead
- Used on a Heavily Reinforced Concrete Bunker
- Integrated on: AF: F-15 & F-16, Navy F-14 & F-18
- Fuzes: FMU-81, FMU-139, FMU-143, FMU-152 & FMU-159
- Improvement Program
  - Autonomous INS/GPS Laser Guided Provides Adverse Weather Capability

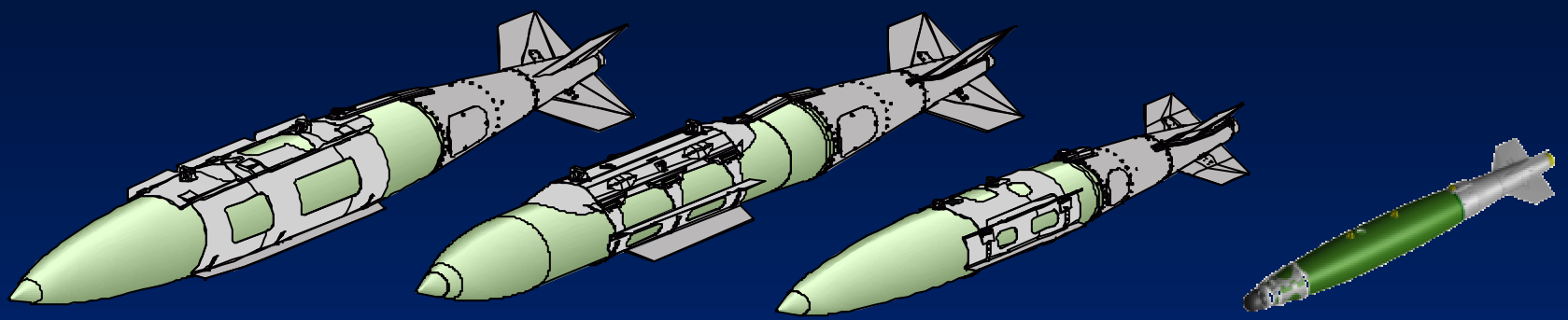
GBU/EGBU-27 Missile System Description

- Laser Guided Munition Designed for Horizontal and Vertical, Hardened and Deeply Buried Targets
  - Laser Designator (Aircraft or Ground)
  - Laser Guided BLU-109A/B 2000 Lb. Warhead
  - Fuzes: FMU-143, FMU-152 & FMU-159
- Used on a Heavily Reinforced Concrete Bunker
- Integrated on the AF F-15, F-16 & F117
- Improvement Program
  - Autonomous INS/GPS along with Laser Guidance Provides Adverse Weather Capability

GBU/EGBU-28 Missile System Description

- Laser Guided Munition Designed for Super Hardened and Deeply Buried Targets
  - Laser Designator (Aircraft or Ground)
  - WGU 36A/B Laser Guidance Unit
  - BLU-113A/B Penetrator Warhead (5000 LB)
  - Fuzes: FMU-143, FMU-152 & FMU-159
- Integration
  - GBU-28 Integrated F-15E Strike Eagle
  - EGBU-28 B-2 Integration Dec 03, EGBU-28 Integration F-15E planned FY04
- Improvement Program
  - Examining Rock Penetration Characteristics
  - Autonomous INS/GPS Adverse Weather Capability

Joint Direct Attack Munition (JDAM) System Description



Mk-84 BLU-109 Mk-83, BLU-110 Mk-82

- Joint Air Force/navy Program to Develop Affordable, Adverse Weather, & Accurate Guidance Kit for 1000 and 2000 Pound Bombs… Eliminate Higher Cost, Limited Utility Interim Weapons
- It Is a INS/GPS Guidance Kit That Attaches to the Bomb and Uses Controlled Tail Fin Movements to Direct the Bomb to the Target
- Fuzes: FMU-139, FMU-143, FMU-152 & DSU-33 Proximity Sensor
- Allows US Forces Precision Engagement in All Flyable Weather
- Lethal...Multiple Kills Per Pass + Fire and Forget
- Interoperable…bombers, Fighters, Carrier, Bare Base
  - B-2, B-52, B-1, FA-18, AV-8B, F-22, F-117, F-16, F-15, JSF
- Affordable - Extremely High Capability to Cost Ratio

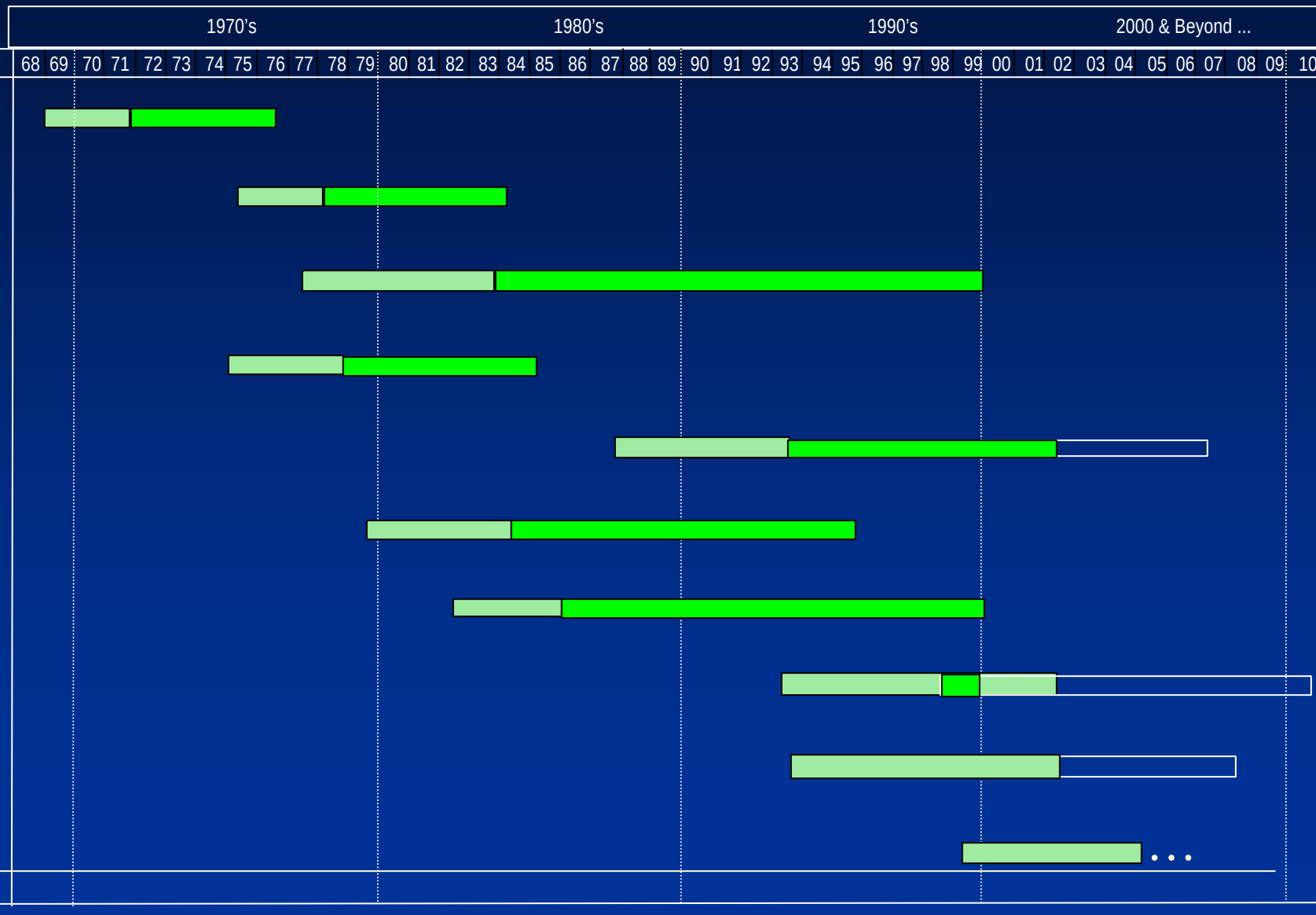
Blast Fragmentation/Penetrator Combined/Designs

- AGM-158 Joint Air-to-Surface Standoff Munition (JASSM)
- A Joint Air Force and Navy Program to Provide an Autonomous, Medium Range, Conventional, Air-to-Surface, Precision Missile Ab to Strike Highly Defended, High Value Targets
  - WDU-42/B (1000 Lb..) Warhead Provides Penetration, Blast & Fragmentation Kill Mechanism Against all Designated JASSM Targets
  - INS/GPS Mid-Course Guidance
  - I2R Seeker
  - Adverse Weather Capability
  - Fuze: FMU-156
- For Integration on F-16, B-52, B-1B, B-2, F/A-18
- 15 Year Bumper-to-Bumper Warranty

Fuze/Weapon Compatibility

Weapon System	FMU 143	FMU 124	FMU 152	JUF	DSU 33	FMU 159	FMU 139	FMU 156	Multi-Event
Mk 80 Series			X		X		X		
BLU-109/113	X		X			X			
JDAM	X		X		X		X		
GBU-15/AGM-130	X	X	X						
GBU-24/27	X		X			X	X		
JSOW Unitary				X					
JASSM								X	
GBU-28/37	X		X			X			
AGM-142	X	X							
AUP						X			
AGM-86D						X			
TTPV						X			
ADW						X			

Fuzes/Sensors Schedule History



Inventory Fuzes

- *Unguided Clusters*
- *Guided Bombs*
- *General Purpose Bombs*

Development/Production Fuzes

- *FMU-143*
- *FMU-152 Joint Programmable Fuze*
- *DSU-33 A/B Proximity Sensor*
- *FMU-159 Hard Target Smart Fuze*
- *Multi-Event Hard Target Fuze*

Fuze Compatibility

Unguided Clusters

Function	Type	Weapon	Remarks
Time	MK-339	M129E1	Leaflets
Time or Proximity	TMD Fuze/ FZU-39	CBU-87 89,97	

Fuze Compatibility

Guided Bombs

unction	Type	Weapon	Remarks
mpact or Impact Delay (Optional)	FMU-81/B	GBU-10/12 (LGB) MK-82, MK-84	
	FMU-124	GBU-15, AGM-130, AGM-142, MK-84	
	FMU-139/B	GBU-24, AGM-65	Replaces FMU-81/
	FMU-143 B/B	GBU-10/24/27, GBU-15, AGM-130, AGM-142, BLU-109/B	
	FMU-143 F/B	GBU-28G/B, H/B 650	

Fuze Compatibility

General Purpose Bombs

Function	Type	Weapon	Remarks
Time	M-904	No Hi Drag	
	M-905	No Hi Drag	
	FMU-54A/B	No Hi Drag	
	FMU-54/B		
	FMU-139 A/B		
Proximity	FMU-113	No Hi Drag	
	DSU-33A/B		
	DSU-33B/B		

FMU-143B/B Fuze

- Full Rate Production
- Contractor: Dayron
- Used on BLU-109, I-800, BLU-113 Warheads
- Arming Times 5.5 and 12 Seconds
- Impact Delay 0.06 Seconds

FMU-143 Fuze System

Configuration	User	Modification
FMU-143B/B and FMU-143B(D-2)/B	AF, FMS, JDAM	Basic
FMU-143D/B and FMU-143D(D-2)/B	AGM-142	21 Sec Arm Time
FMU-143E/B and FMU-143(D-1)/B	Navy	PBXN-7 Booster/Lead
FMU-143F/B	GBU-28	30ms Delay/21 Sec Arm
FMU-143G/B	GBU-28	60ms Delay Same
FMU-143H/B	GBU-28	120ms Delay Same

Joint Programmable Fuze (JPF)

FMU-152A/B

JPF System Description

- Single Fuze Compatible with Mk82, Mk83, Mk 84, BLU-109, BLU-113 for use in AGM-130, GBU-10/12/15/24/27/28 and All JDAM Variants
- Can be Used in Current FMU-139 and FMU-143 Applications
- Cockpit Selectable Arm/Delay Times
  - Arm 2-25 seconds
  - Delay instantaneous to 24 Hours
- Multi-Function Capability
  - Hard Target Penetrator Weapons
  - Blast Fragmentation
  - Backward Compatibility With Current Weapons

JPF Requirements

Performance	Threshold Parameters
Weapon Interface	**AGM-130, GBU-10/12/15/24/27/28, JDAM**
Warhead Interface	**MK-82/83/84, BLU-109/113**
Long Drag Arm Time (Sec)	4.0, **4.5,** ***5.0,*** **5.5,** 6.0, **6.5,** 7.0, **7.5,** 8.0, **8.5, 9.0,** 10.0, 14.0, **21.0,** 25.0
High Drag Arm Time (Sec)	2.0, 2.6, 3.0, 3.5, 4.0, 5.0
Impact Delay Times	0, 5, **15,** 25, **35, 45,** 60, **90,** 180, **240 Msecs** 15, **30, 45, 60 Min** 4, **8, 12, 16, 20,** 24 **Hrs**
Reliability	**0.98**
Service Life	**10 Years**
Shelf Life	**20 Years**

High Altitude Low Airspeed (HALA)

History

- Fuze Performed Well Until Tested On JDAM/BLU-109 at High Altitude
- 2000- Present JDAM/JPF Red Team, Wind Tunnel Tests, Fuze Upgrade Activities
  - Principal Problem: Low Power Output From FZU Due to Inadequate Airflow
- Recommended Solutions
  - FZU Redesign (Baseline Plus Alternative)
  - Fuze Hardware/software Changes
- Sep 01 – Feb 02 -- Government/Dayron Conducted Tests
  - Data Verifies Improved Performance, More Testing Planned
- Current Restructure- Incorporate HALA changes into First Article Acceptance Testing; Field one configuration.

JPF - Solutions

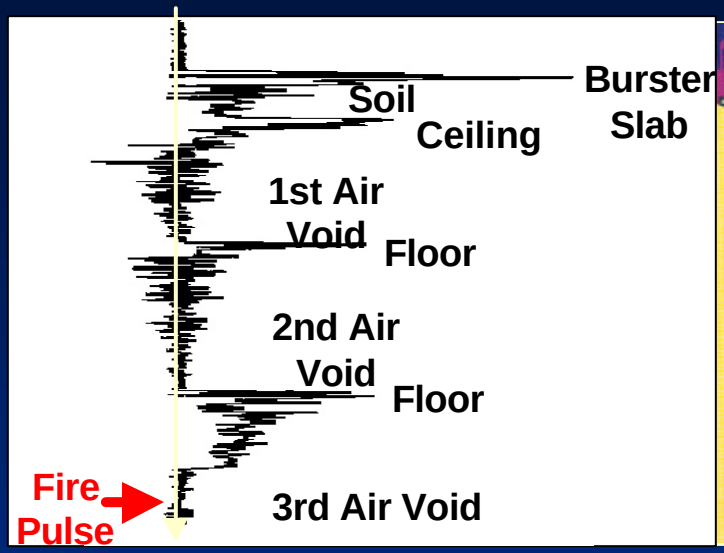
- **FZU-55A/B Initiator - Improve Power Output**
  - **Doubles Start-up and Output Voltage**
- **FMU-152A/B Fuze - Modify Fuze Logic to Handle Low Power Conditions**
  - **Allows Restart of Microprocessor After Power Dropout**
  - **Modify Software to Monitor Arming Energy and Delay Arming Until “Power Good”**

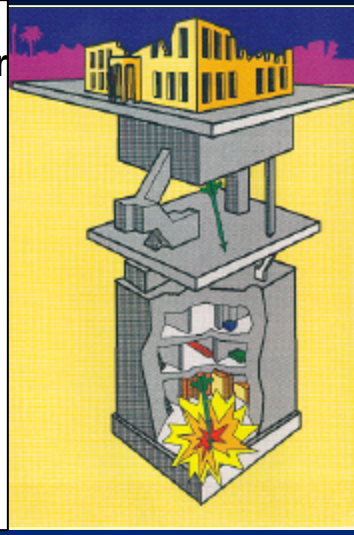
Hard Target Smart Fuze (HTSF)

FMU-159A/B

HTSF Description

- Accelerometer-based fuze
  - Void sensing
  - Hard layer count
  - Depth of burial
  - Back-up Timer
- Compatible with existing fuze wells.
- Potential weapon systems
  - GBU-24, -27, -28, -37, -31
  - GBU-15, AGM-130, AGM-142,
  - AGM-86/D, Tactical Tomahawk Penetrator Variant
- Contractor: Alliant Techsystems (ATK)





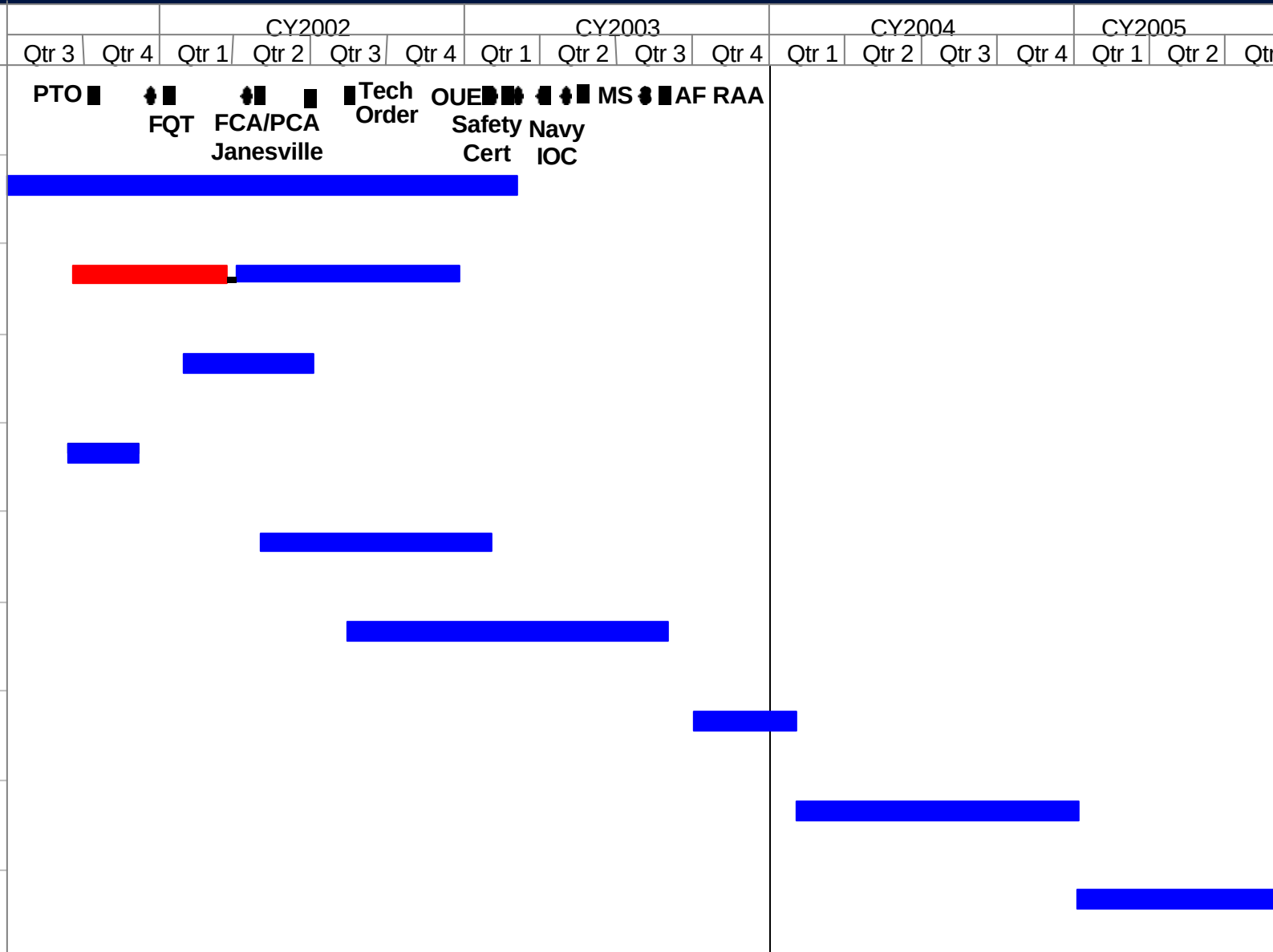
FMU-159A/B Hard Target Smart Fuze Warheads / Weapons

- **Penetrator Warheads: BLU-109 / 113 / 116, WDU-43**

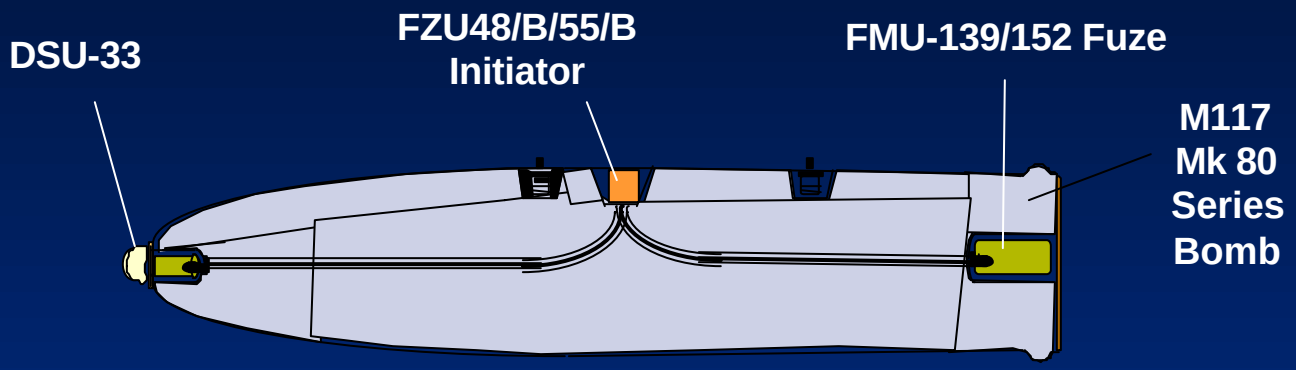
- **USAF Weapons:**
  - **GBU-28 & EGBU-28, GBU-37**
  - **GBU-24/27 & EGBU-24/27**
  - **CALCM Penetrator (AGM-86D)**
  - **AGM-130 / GBU-15**
  - **GBU-31/32 (JDAM)**

- **Navy Weapons:**
  - **GBU-24 & EGBU-24 with AUP**
  - **Tactical Tomahawk Penetrator Variant (TTPV)**
  - **GBU-31/32 (JDAM)**
  - **Agent Defeat Weapon ACTD**

FMU-159A/B Hard Target Smart Fuze Schedule

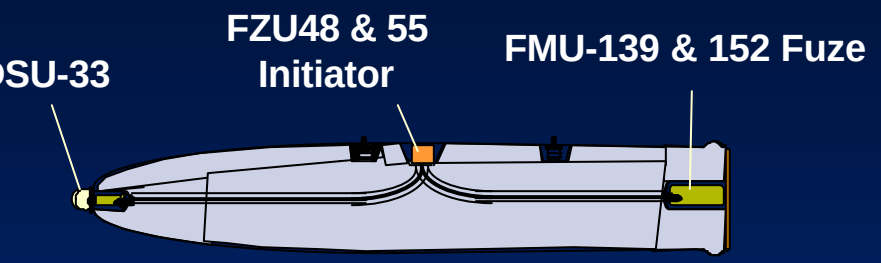


DSU-33 Proximity Sensor



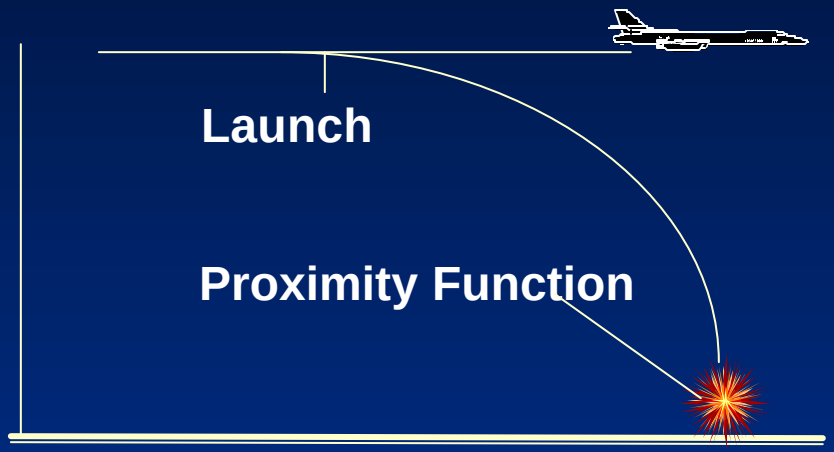
Air Force Configured System

DSU-33 Proximity Sensor



Air Force Configured System

Operational Concept



System Description

Low Level RADAR Proximity Sensor

Provides Fire Pulse Signal to the FMU-139 and FMU-152 Fuze

Self Powered: Initiated by FZU or FFCS

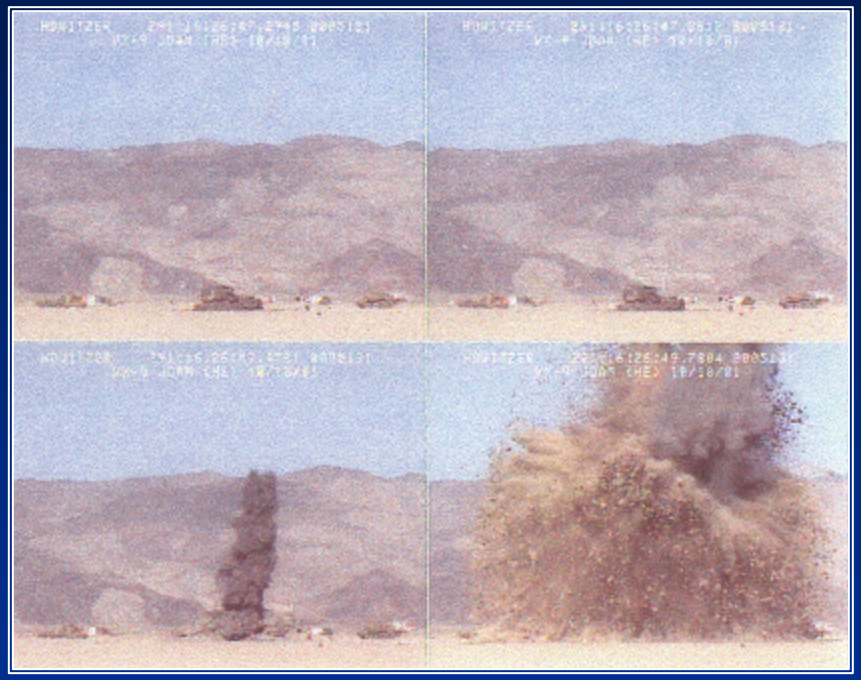
- DSU-33A/B: 60-90 Sec - GP Bombs
- DSU-33B/B: 200 Sec - JDAM

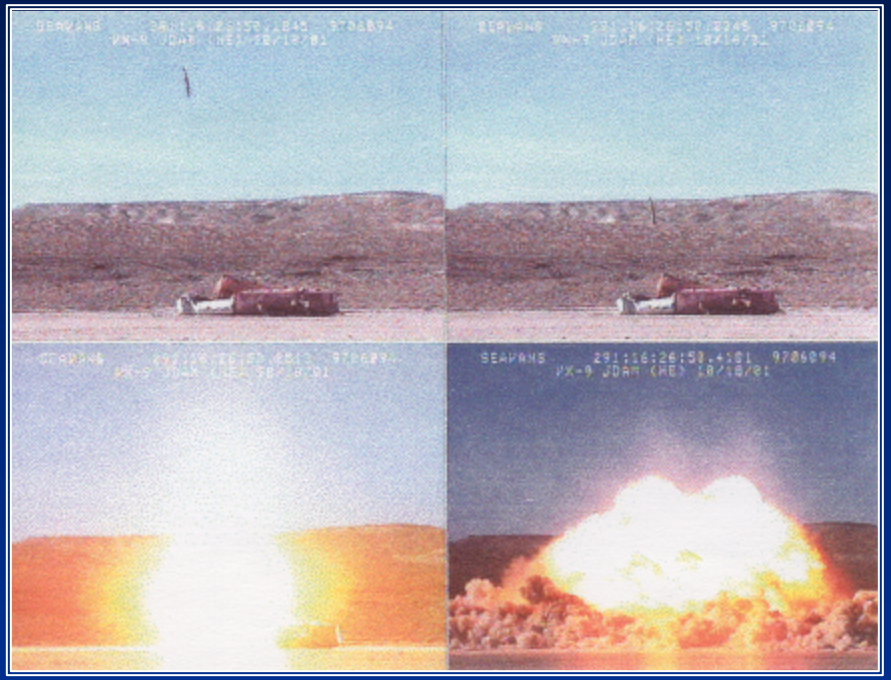
Provides Air Burst Proximity Fuzing for

Performance Requirements

- Employment on A10, F15, F16, F22, B1, B2 B52, F/A18, AV8, and F14 Acft
- All Altitudes and Airspeeds
- Height of Burst (HOB) 20 Feet (Nominal)
- Over all Water and Land Surface Condition

Delay Burst Vs Air Burst W/JDAM





Multiple Event Hard Target Fuze

Burst Point Control Fuzing for Future Penetrating Weapons

Separate Briefing

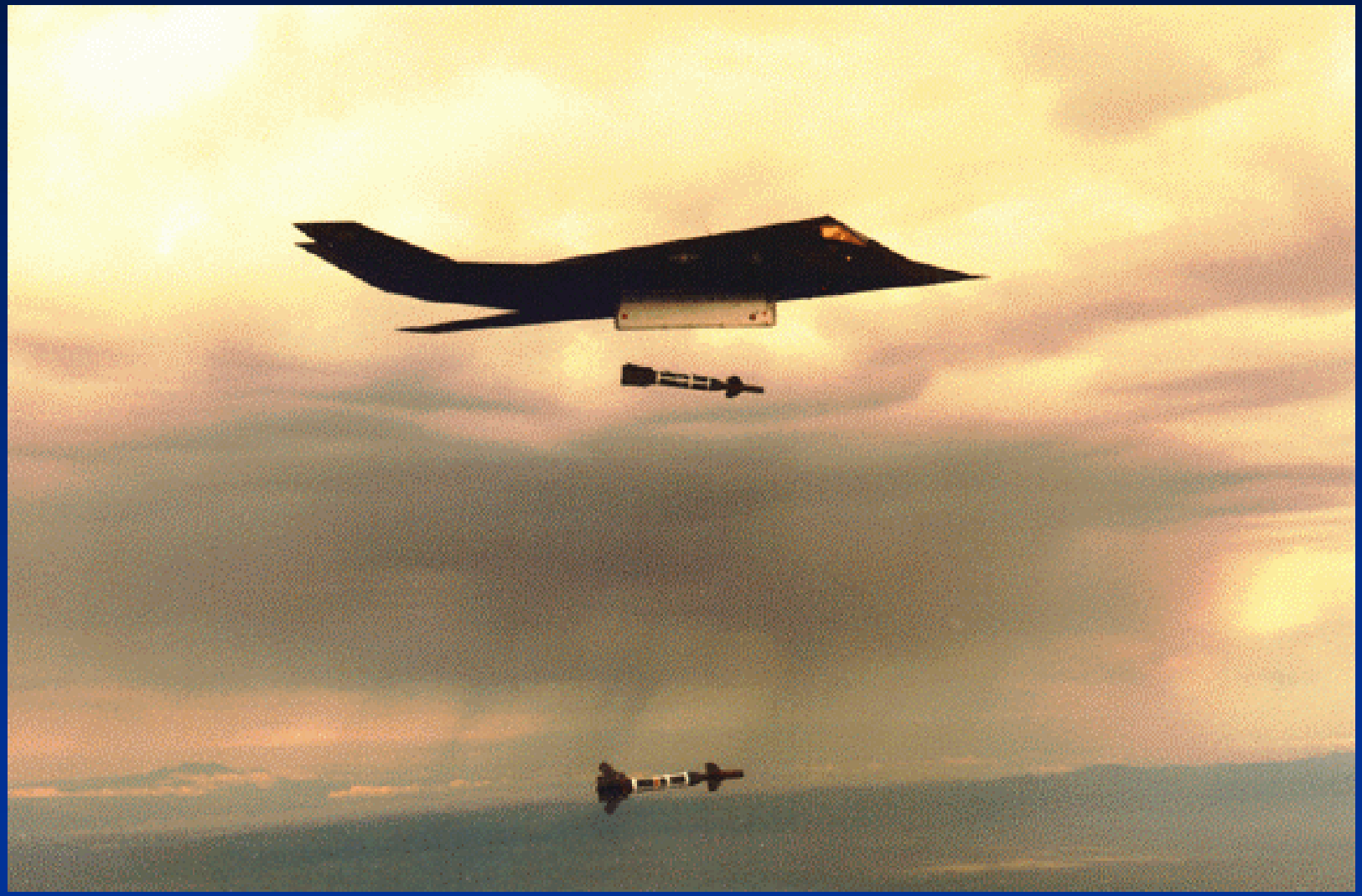
Observations Regarding The Business Base for DOD Fuzing

- *Budgets for PGMs dramatically increased,*
  - *Prime examples: JDAM and LGB's*
  - *without sufficient provision for increased fuze or warhead quantities*
- *The Business Case substantiates overall industry growth in fuzing*
  - *Quantities likely to be greatly expanded in near future*
  - *Fuzing now recognized by service acquisition executives as the risk driver in most weapon systems*
- *Opportunities abound at all levels*
  - *Critical supplier base must be maintained for unique components (e.g. explosive devices and batteries)*

Things to Remember

- System Safety
- System Performance- Installed
- Availability and Reliability
- Effectiveness of Defeat Mechanisms
- Collateral Damage
- Multiple Event Requirements
- High G Environments/High Velocity
- Weapon/Aircraft Compatibility
- Mission Planning
- Miniaturization
- Versatility/Agility
- Past Performance and Corrective Action

Questions?



JASSM DT-6

15 Dec 01